

Computer Vision and Image Analysis Course

Lab 2: Camera Projection and Relative Pose computation

Interdisciplinary Space Master (ISM)
Interdisciplinary Centre for Security, Reliability and Trust
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In the previous task you learnt how to compute the camera intrinsic parameters. In this task you will learn how to utilize camera intrinsic parameters to do projection from real world to camera frame.

2.1 Compute Relative Pose

In the folder, you have the sample image and the corresponding pose information.

1. Read the pose.json file. The pose information in the JSON file contains the position (x,y,z) and quaternion (qx, qy, qz, qw).

```
"cam_r"# Camera's Position in the world reference frame
"cam_q"# Camera's Orientation in the world reference frame
"sat_r"# Satellite's Position in the world reference frame
"sat_q"# Satellite's Orientation in the world reference frame
```

```
# useful imports
import json
import os

import numpy as np
import pandas as pd

# to read the json file
file_path = os.path.join(root_dir, "pose.json")
if os.path.exists(file_path):
    data = pd.read_json(file_path)
else:
    print("File not available. Please check the file path.")
    return

# to read data from the panda data for the corresponding index
<extraction_tag> = data.loc[index, '<extraction_tag>']
```

2. Perform frame transformation and compute the relative pose of the satellite in the Camera's reference Frame. **Use the Computed relative pose in the Report.**

2.2 Camera Projection

1. Read the camera.json for the intrinsic parameters necessary to construct the camera calibration matrix.

```
nu # number of horizontal[pixels]
nv # number of vertical[pixels]
ppx # horizontal pixel pitch[m / pixel]
ppy # vertical pixel pitch[m / pixel]
fx # focal length[m]
fy # focal length[m]
ccx # center along horizontal [pixels]
ccy # center along vertical[pixels]
```

2. Project the pose information calculated from 2.1 on the given image and verify if the pose is correct. **For the report, plot an image overlaying the satellite's coordinate axes in RGB on the given image and also print pose information the bottom right corner of the image.**

2.3 Project Keypoints

1. Read the points3d.txt files for the position of the keypoints in the satellite own reference frame. The keypoint location are in the format (x,y,z).
2. Find the position of the keypoints relative to the camera using the pose information calculated from 2.1. **Print the locations of the keypoints in the Camera's Reference Frame.**
3. Project the estimated 3D position of the keypoints onto image using the information and compute the 2D coordinates of the image keypoints. **Plot the image with identified keypoint locations.**

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